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(54) **RESILIENT FLOOR**

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(58) **Field of Classification Search**

CPC E04F 15/02038; E04F 15/10; E04F 2201/0153; E04F 2201/0146; E04F 2201/0138

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See application file for complete search history.

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(57) **ABSTRACT**

A method of assembling resilient floorboards is disclosed that includes the step of bending an edge of a floorboard during the assembling. The bending reduces the force required for connection of the edge to another edge of a juxtaposed floorboard.

20 Claims, 9 Drawing Sheets

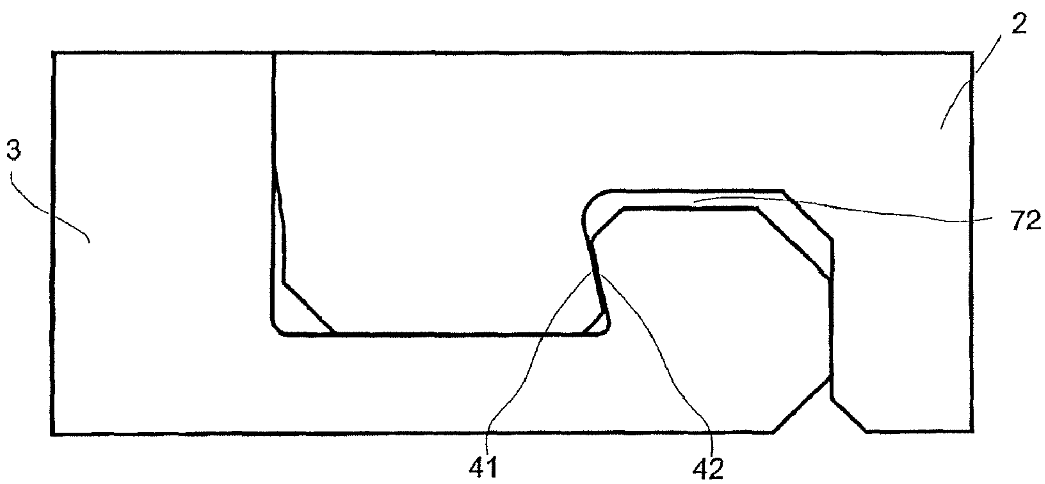

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Fig 1a

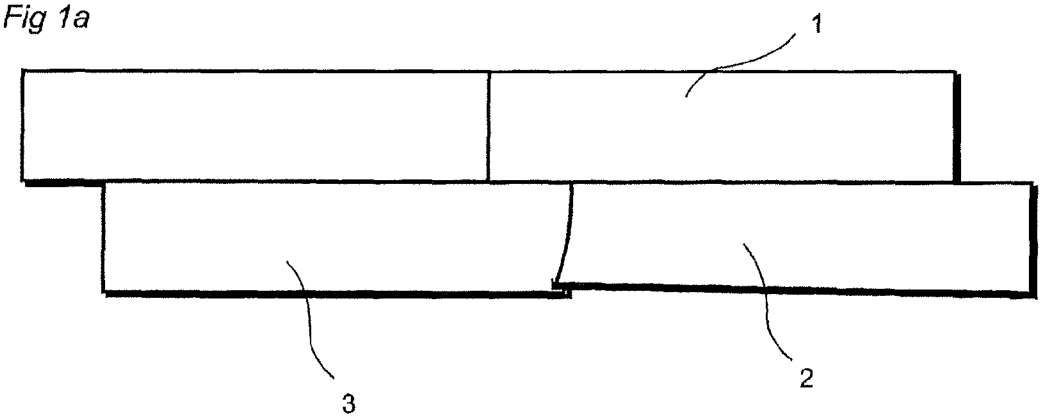


Fig 1b

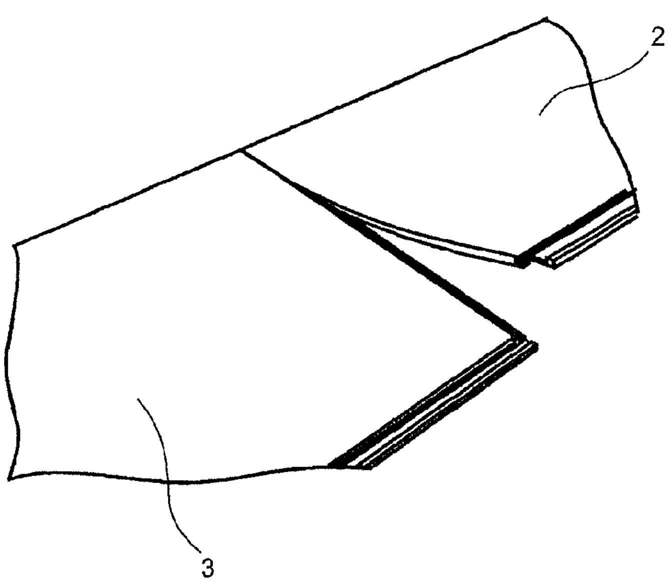


Fig 2a

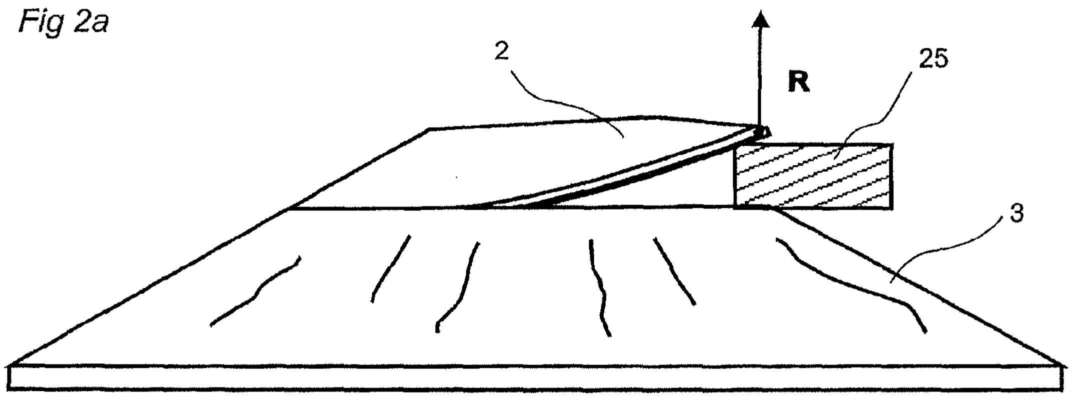
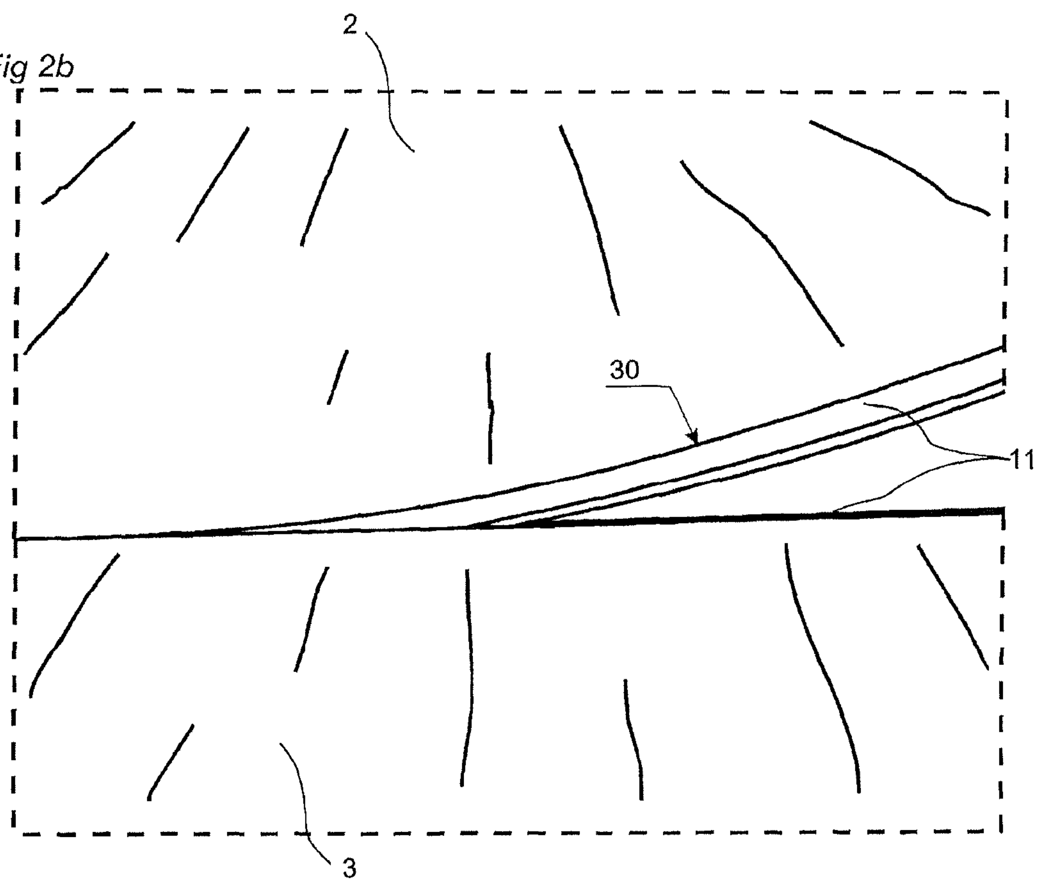


Fig 2b



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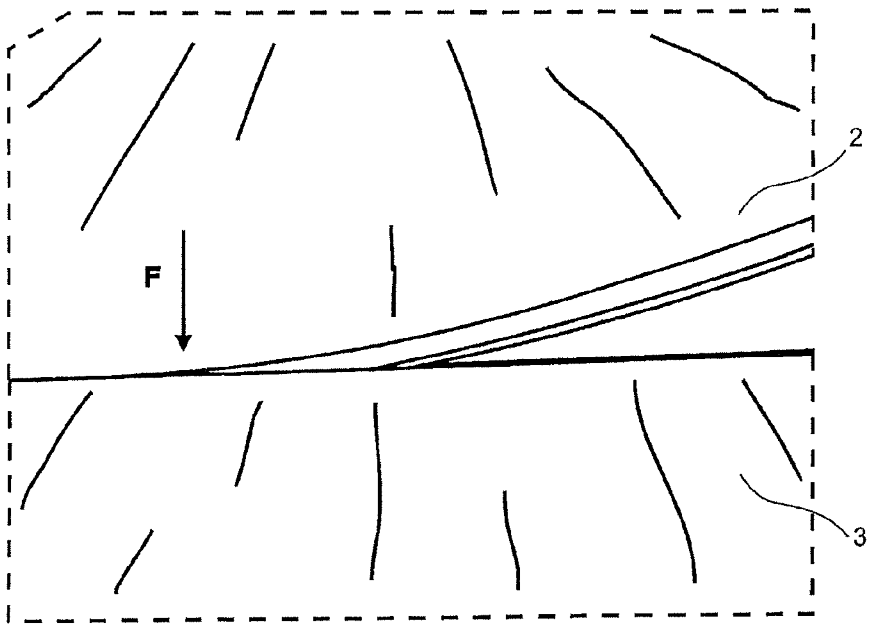
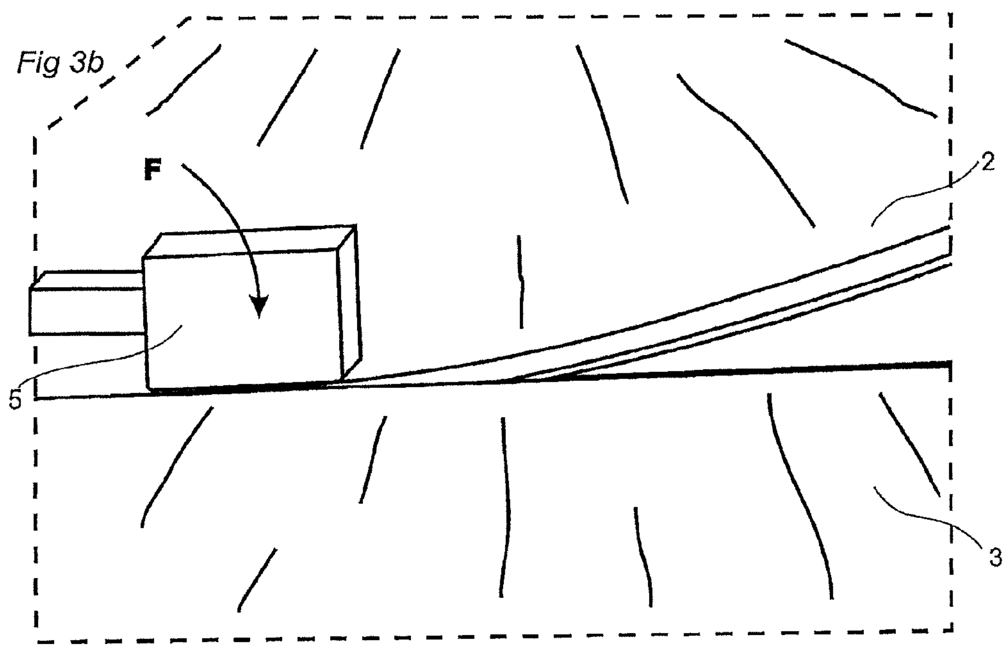


Fig 3b



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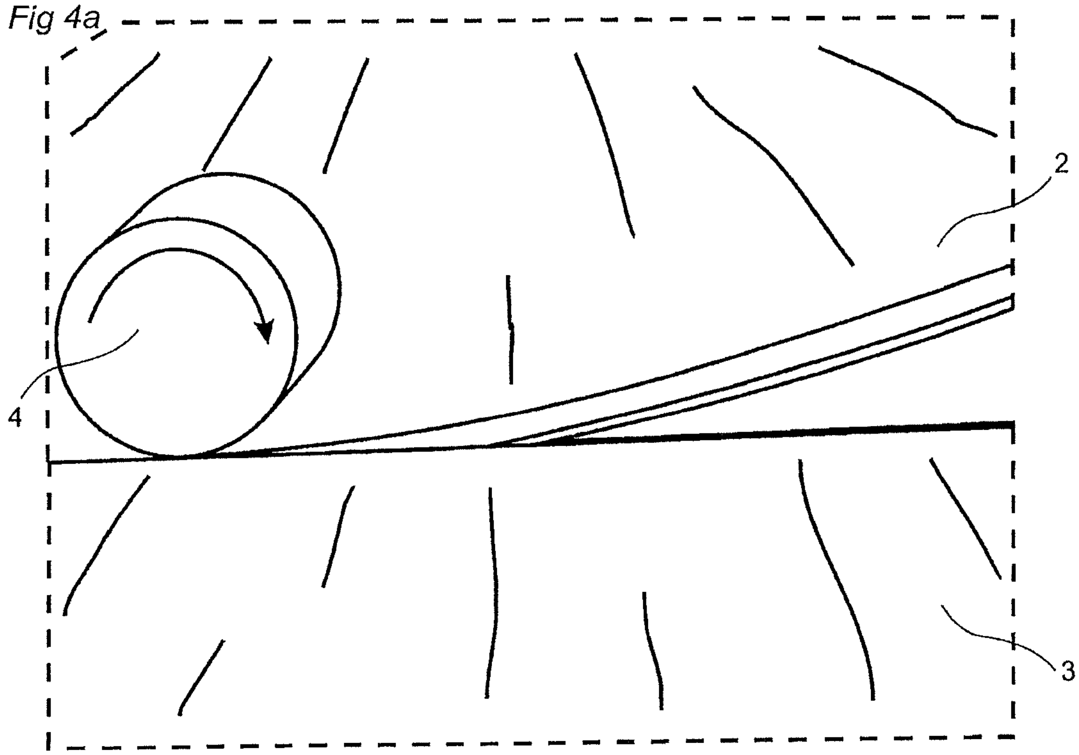

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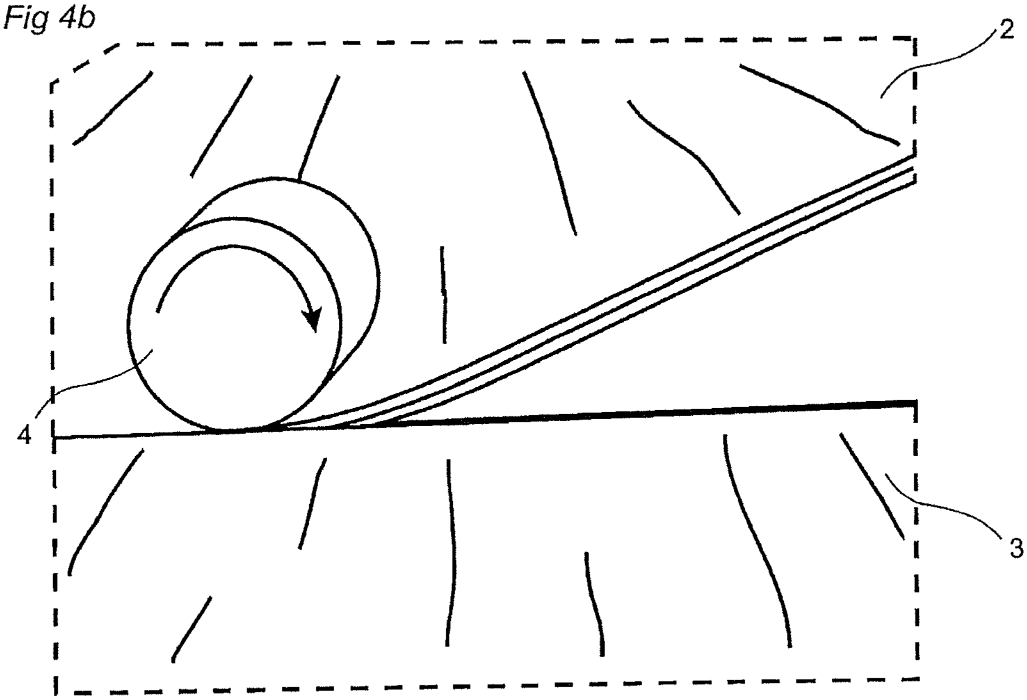

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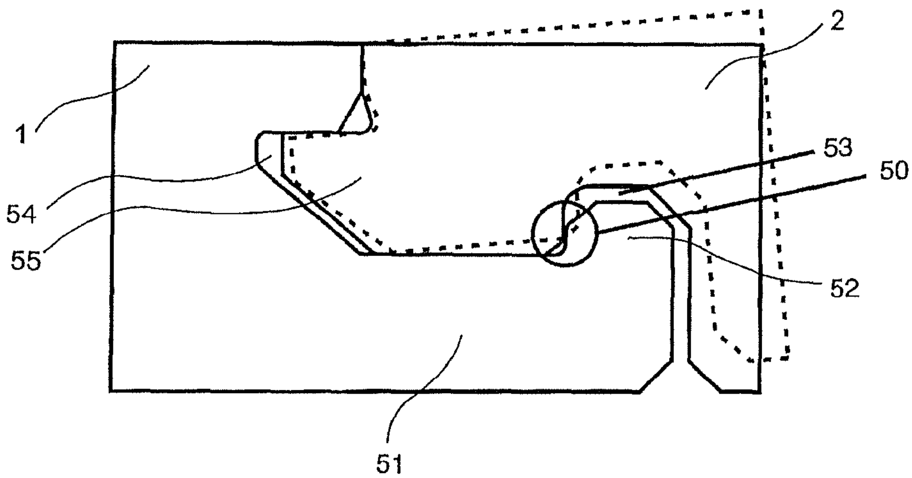
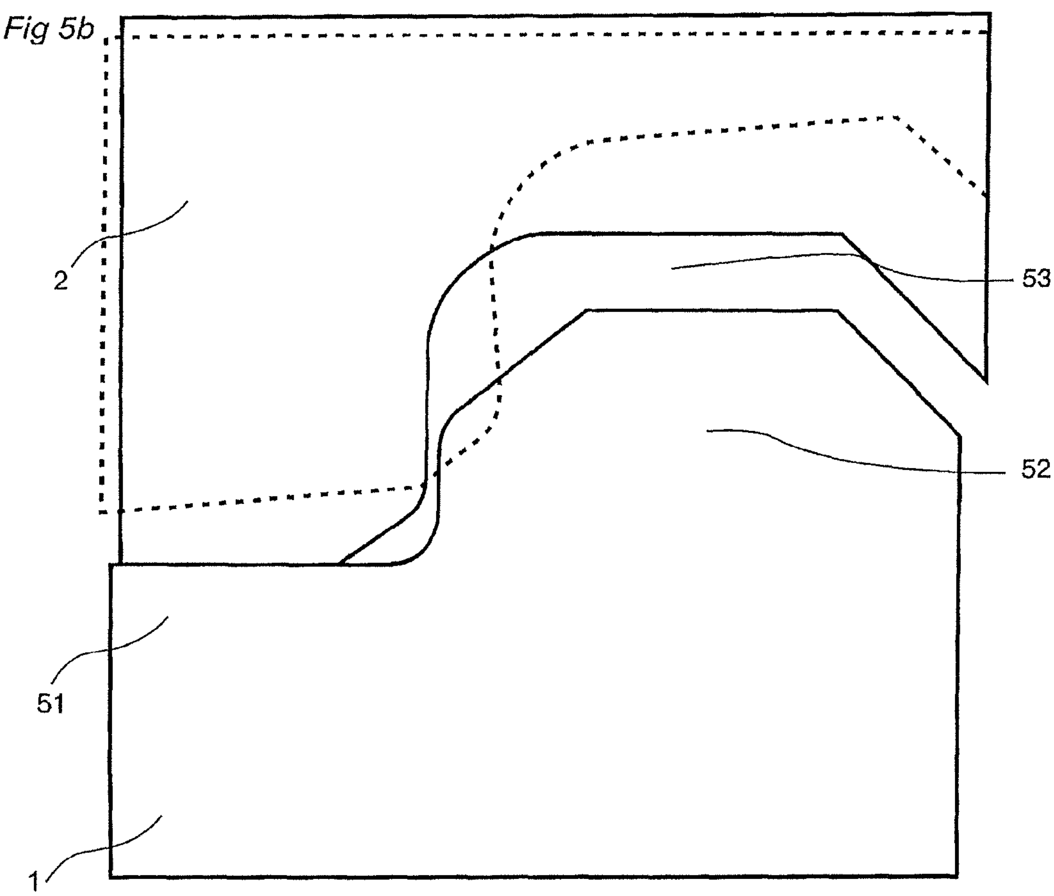


Fig 5b



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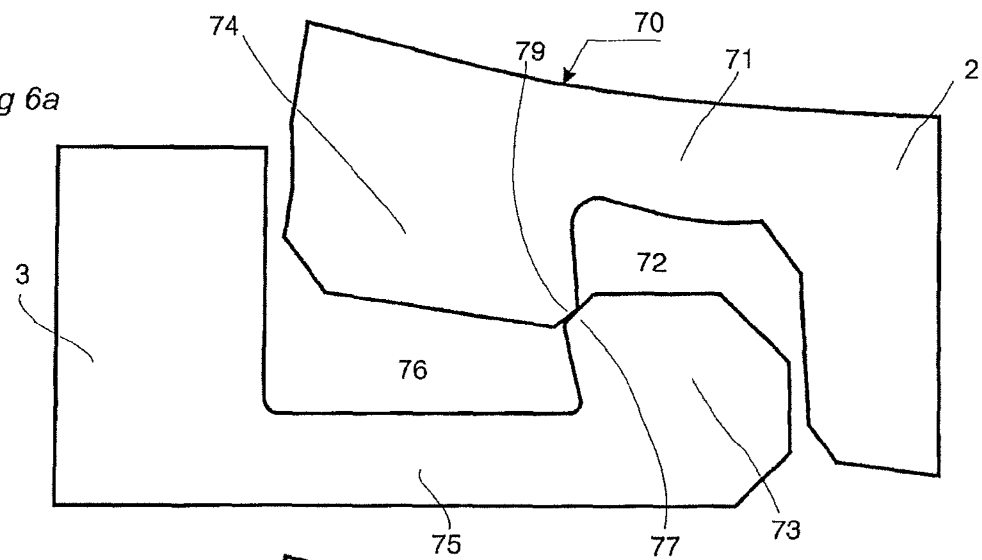


Fig 6b

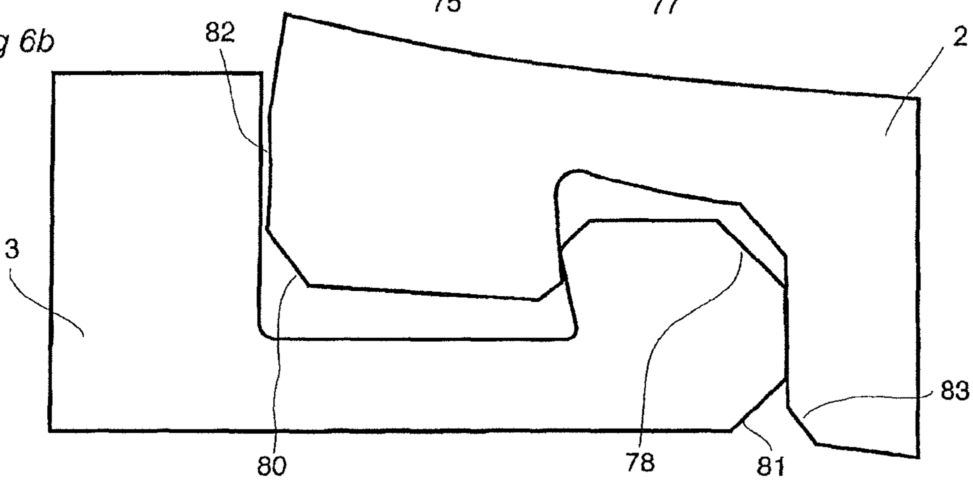
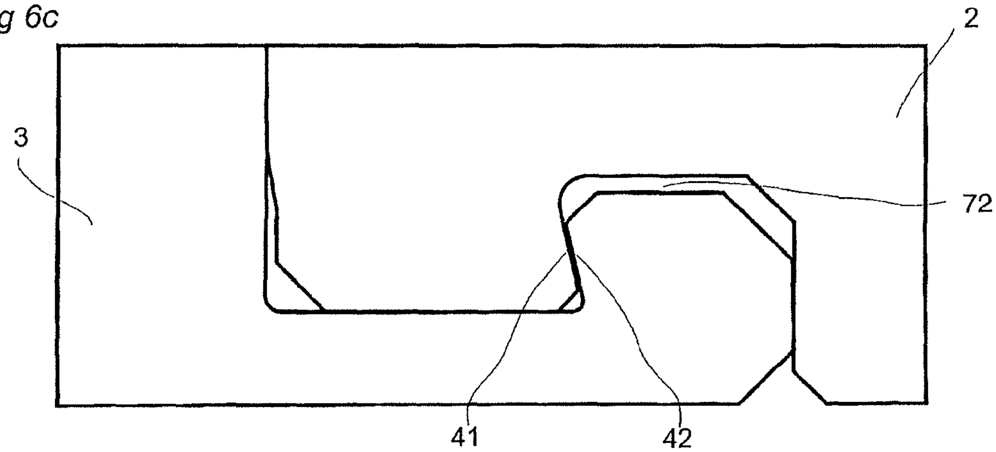


Fig 6c



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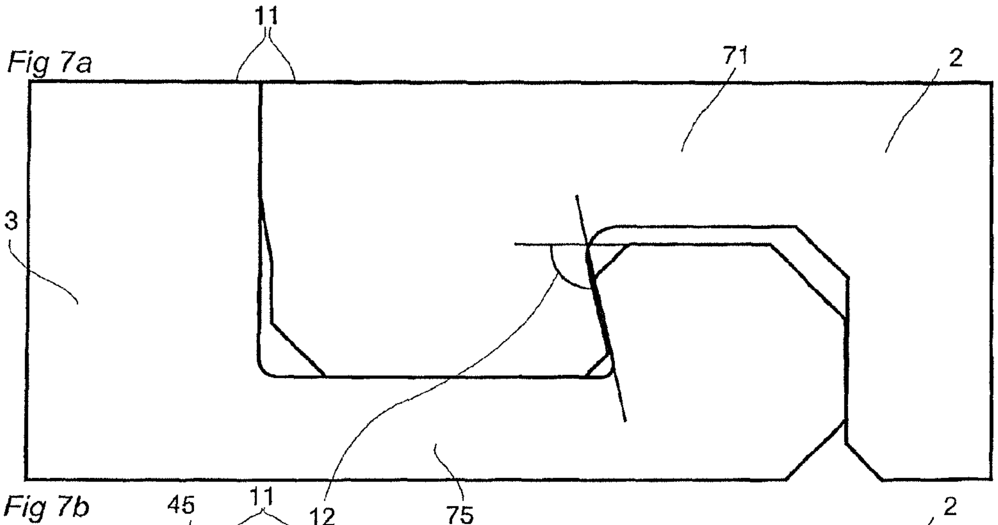


Fig 7b

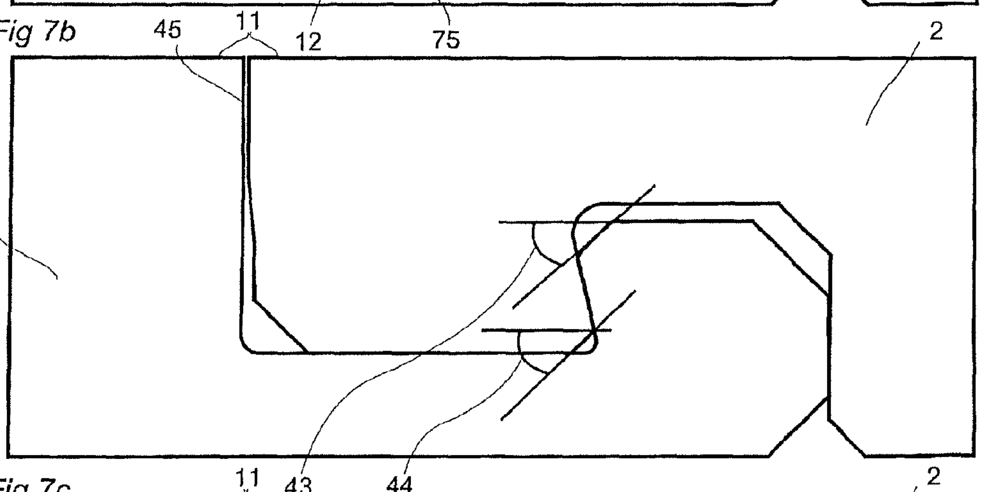


Fig 7c

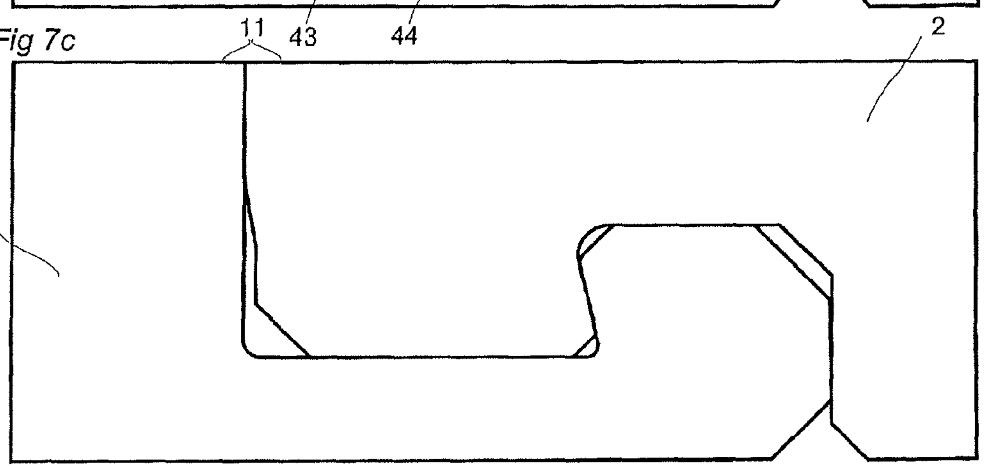


Fig 8a

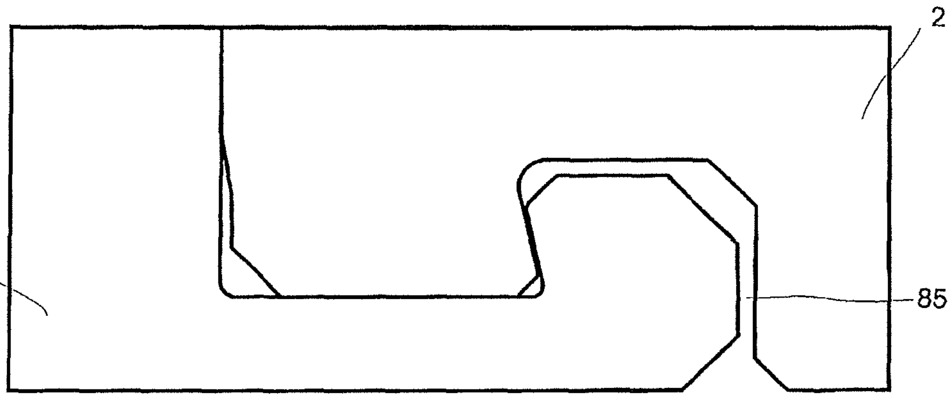


Fig 8b

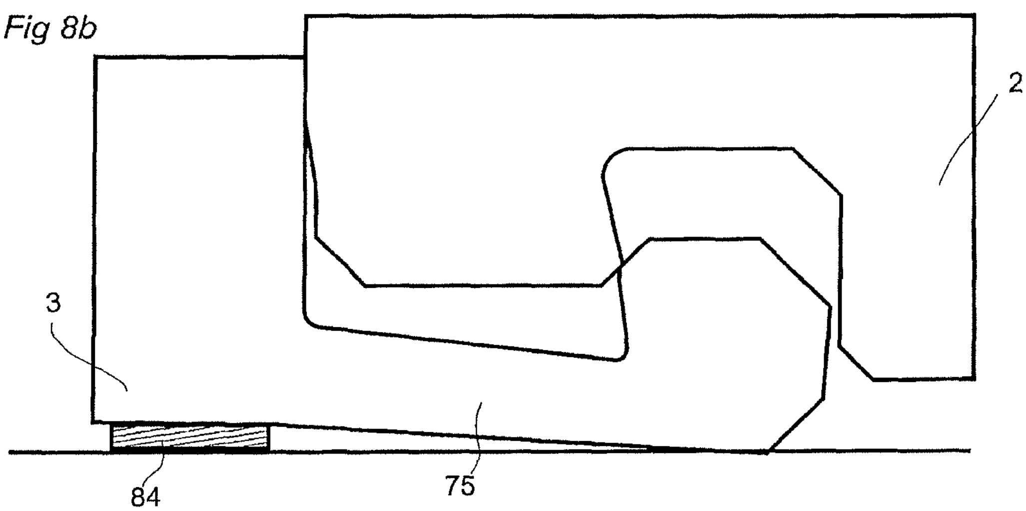


Fig 8c

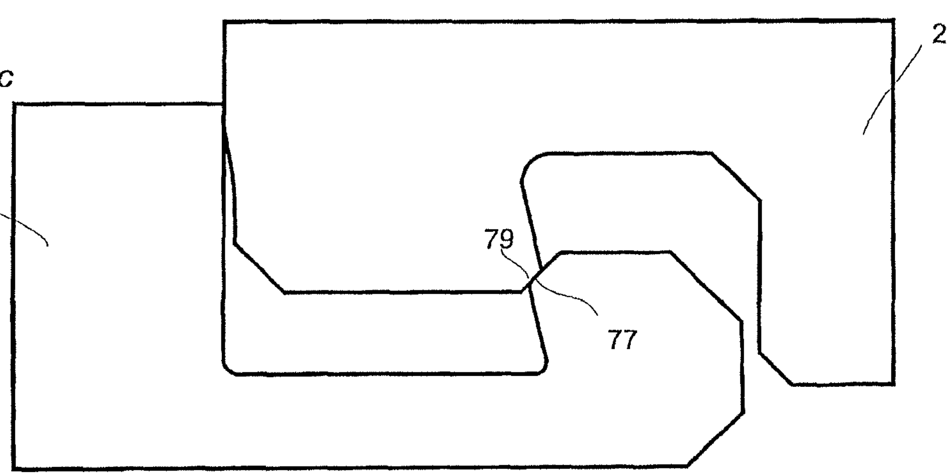


Fig 9a

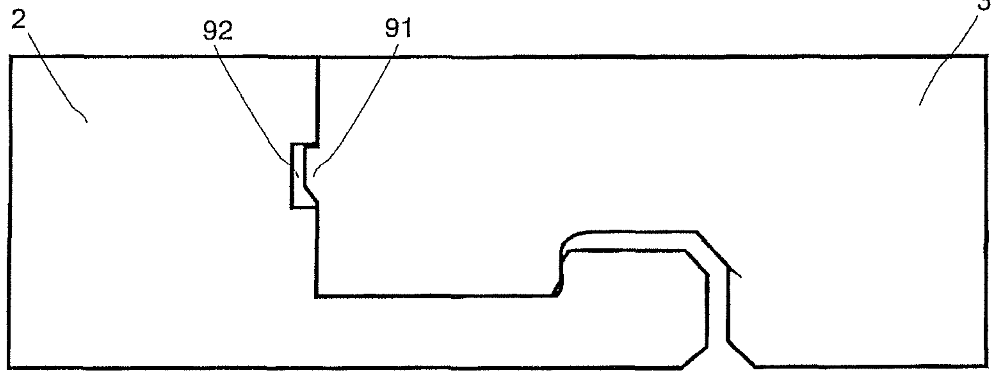
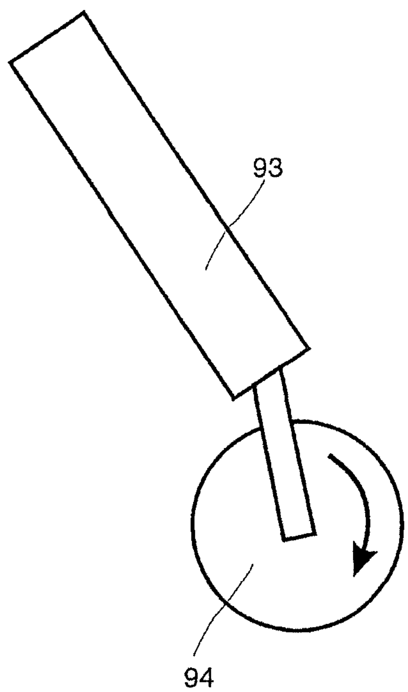


Fig 9b



RESILIENT FLOOR

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. application Ser. No. 13/734,406, filed on Jan. 4, 2013, which is a continuation of U.S. application Ser. No. 12/875,293, filed on Sep. 3, 2010, now U.S. Pat. No. 8,365,499, which claims benefit to U.S. Provisional Application No. 61/239,927, filed Sep. 4, 2009. U.S. application Ser. No. 13/734,406, U.S. application Ser. No. 12/875,293 and U.S. Provisional Application No. 61/239,927 are each hereby incorporated by reference in its entirety.

TECHNICAL FIELD

The present invention generally concerns a method of assembling of floorboards provided with a mechanical locking system.

BACKGROUND OF THE INVENTION

Floorboards with a wood based core that are provided with a mechanical locking system and methods of assembling such floorboards by angling-angling, angling-snapping or vertical folding are disclosed in e.g. WO 94/26999, WO 01/77461, WO 2006/043893 and WO 01/75247. Floorboards of resilient material, e.g. PVC, are known, commonly referred to as LVT (Luxury Vinyl Tiles) that are glued down to the subfloor or bonded at the edges to each other WO 2008/008824.

SUMMARY OF THE INVENTION

A method is disclosed for assembling of floorboards, which are so called resilient floorboards i.e. the core is of a resilient material for example vinyl or PVC. The known methods of assembling floorboards that are mentioned above are difficult to use when assembling resilient floorboards since resilient floorboards easily bend which make it hard to use the angling-angling method and it is unfeasible to use the angling-snapping method since it requires a force to be applied, at an opposite edge in relation to the edge of the floorboard which is intended to be connected, by e.g. a hammer and a tapping block and the resilient core of the resilient floorboard absorbs the applied force. The known vertical folding methods are also difficult to apply due to the increased friction in the resilient material. The disclosed method makes the assembling easier and reduces the force needed for connection of the floorboards.

Furthermore, a locking system suitable for the method is disclosed. The locking system decreases the friction forces that must be overcome when installing the resilient floorboards.

An aspect of the invention is a method of assembling resilient floorboards, which are provided with a mechanical locking system, which method comprises the step of:

- positioning a floorboard edge, provided with a first device of said mechanical locking system (**11**), juxtaposed another floorboard edge, provided with a second device of said mechanical locking system (**11**);
- bending (**30**) the floorboard (**2**) along the edge; and
- applying a force (F) on a first part of the floorboard edge, wherein at said first part of the floorboard edge said first device is pushed into said second device to obtain a vertical and horizontal mechanical locking of a part of the floorboards' edges.

The bending makes it possible to finalize the connection of only a part of the edge of the floorboard, instead of the whole edge as in the known methods, and consequently the force needed to assemble the floorboards is considerably reduced.

The bending is preferably achieved by raising an outer part of said edge preferably by positioning of a raising device, e.g. a wedge, or a hand/finger of the assembler under said floorboard. The raised position of the outer part of said edge is preferably maintained during the force-applying step. In a preferred embodiment also the position of the raising device is maintained during the force-applying step.

The method comprises thereafter preferably the step of applying a force to a new part of the edge, which new part is adjacent to the mechanically locked part, and repeating this step until the whole edge is connected to said another edge.

The force is preferably applied by a tool and most preferably by a tool with a rotatable part.

In a preferred embodiment, the first device is an upper locking strip, which is resiliently bendable, with a downwardly protruding locking element and the second device is a lower locking strip provided with an upwardly protruding locking element. The resiliently bendable locking strip facilitates the connection of the floorboards. The downwardly protruding locking element is provided with a locking surface, which cooperates, for horizontal locking, with a locking surface of the upwardly protruding locking element. The locking strips are integrally formed with the resilient floorboards and preferably of the same resilient material. The downwardly and/or the upwardly protruding locking element is preferably provided with a guiding surface which are configured to guide the locking elements in to a position where the floorboards are connected by the locking elements and the locking surfaces cooperate.

The resilient floorboards are in a preferred embodiment made of a bendable thermo plastic, e.g. vinyl, surlyn, and PVC. Floorboards of vinyl are generally referred to as LVT (Luxury Vinyl Tiles). In a most preferred embodiment the thickness of the floorboard is about 4 mm to about 10 mm. If the floorboards are too thin it is hard to produce a locking system integrally in the floorboard material and if they are too thick it is hard to assemble the floorboards with the disclosed method.

The floorboards are in a preferred embodiment provided with an upper decorative layer made of a similar resilient material and most preferably provided with a balancing layer and/or a sublayer.

The force is preferably applied with a tool, which comprises a handle and a press part for applying a force on the floorboard. Preferably, the press part is provided with an outer round or circular shape for applying the force on the floorboard and in the most preferred embodiment the press part is rotatable.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1***a*-*b* show an embodiment of the assembling method.

FIGS. **2***a*-**2***b* show an embodiment of the assembling method.

FIGS. **3***a*-**3***b* show embodiments of the assembling method.

FIGS. **4***a*-**4***b* show embodiments of the assembling method.

FIGS. **5***a*-**5***b* show an embodiment of a locking system configured for connection by angling.

FIGS. **6***a*-**6***c* show an embodiment of resilient floorboards during assembling.

FIGS. **7***a-c* show embodiments of a locking system for resilient floorboards.

FIGS. **8***a*-**8***c* show embodiments of a locking system for resilient floorboards

FIGS. **9***a-b* show an embodiment of a locking system and an embodiment of the assembling tool.

DETAILED DESCRIPTION OF EMBODIMENTS

An embodiment of a method of assembling resilient floorboards (**1**, **2**, **3**) with a mechanical locking system **11** is shown in FIGS. **1***a* and **1***b*. An edge of a floorboard **2** is positioned juxtaposed another edge of another floorboard **3**. The edge of the floorboard is bent (**30**) along the edge during the assembling and the connection of the floorboard edges to each other. In this embodiment the edge and said another edge are short edges and a long edge of the floorboard is connected to a long edge of a floorboard **1** in another row, by a mechanical angling locking system, simultaneous with the short edge connection, by an angular motion.

An embodiment of a mechanical angling locking system is shown in FIGS. **5***a* and **5***b*. Embodiments of the mechanical locking system **11** at the short edges is shown in FIGS. **6***a* to **9***a*. When assembling a complete floor the method shown in FIG. **1***a* is naturally applied and repeated for each resilient floorboard, which is provided with the locking system at each short edge and the mechanical angling locking system at each long side, until all resilient floorboards are connected.

The resilient floorboards may also be of square shape with the mechanical locking system **11** provided at two opposite edges of each floorboard and the mechanical angling locking system provided at two other opposite edges of each floorboard. It is also possible to provide floorboards of rectangular shape with the mechanical locking system **11** at the long edges and the mechanical angling locking system at the short edges.

FIG. **2***a* shows the assembling from another view and FIG. **2***b* shows a detailed view of the bent (**30**) floorboard **2** edge and that a part of the edge is pressed down such that parts of the floorboards **2**,**3** are locked to each other by the mechanical locking system **11**. The edge is pressed down by applying a vertical force F at the edge on the floorboard, as disclosed in FIG. **3***a*, on a part of the edge which is closest to said another edge, wherein the part of the edge is mechanically locked to another part of said another edge by the mechanically locking system **11**. This is repeated until the whole edge is connected vertically and horizontally to said another edge.

The bending of the floorboard makes it possible to finalize the locking of only a part of the edge of the floorboard, instead of the whole edge as in the known methods, and as a result the force required to connect the floorboards is considerably reduced. Since only a part of the edge of the floorboard is locked the area in the mechanical locking system that is in contact during the connection is reduced and consequently the friction created in the mechanical locking is reduced and thereby the force required. The bending is preferably achieved by raising (R) an outer part of said edge by positioning of a raising device (**25**), e.g. a wedge, or a hand/finger of the assembler under said floorboard. The position of the raising device is maintained during the force-applying step.

The force may be applied directly, without tools, on the floorboard e.g. by a hand or a foot of the assembler. However, a tool **4**,**5** may be used to apply the force as disclosed in FIGS. **3***b*, **4***a* and **4***b*. In FIG. **4***b* only a part of the floorboard is bent while the rest of the floorboard edge continues straight in the direction of the tangent of the bent part. Most preferably a tool with a rotatable press part is used to apply the force. FIG. **9***b* shows an embodiment of such a tool.

The floorboard-assembling tool in FIG. **9***b* comprises a handle **93** and press part **94**, which is of a circular shape. The rotatable press part **94** makes it easy to move the tool, by one hand of the assembler, along the edge of the floorboard, which is going to be connected, and bend the floorboard with the other hand.

The mechanical angling locking system in FIG. **5***a-b* comprises a locking strip **51**, a locking element **52** and a tongue groove **54** at an edge of a resilient floorboard **1** and a locking groove **53** and a tongue **55** at an edge of an adjacent resilient floorboard **2**. The tongue **55** cooperates with the tongue groove **54** for vertical locking and the locking element **52** cooperates with the locking groove **53** for horizontal locking, similar to the angling locking systems disclosed in WO 01/77461.

Compared to the locking system, which is produced in a wood based core, disclosed in WO 01/77461 it is possible to produce a mechanical angling locking system in a resilient floorboard with a shorter locking strip and/or higher locking angle and/or increased locking surface area, as disclosed in FIG. **5***b*, which is an enlarged view of area **50** in FIG. **5***a*. This is due to the resilient material, which makes it possible to bend the locking strip more without breaking it. The angling locking system is preferably integrally formed in one piece with the resilient material of the floorboard.

An embodiment of the mechanical locking system is disclosed in FIGS. **6***a*-**6***c* in which figures a cross-section of the locking system is shown in three sequential steps during the connection. A first device of the mechanical locking system comprises an upper, and upwardly resiliently bendable, locking strip **71** at an edge of a floorboard **2** and a second device of the mechanical locking system comprises a lower locking strip **75** at an edge of another floorboard **3**. The upper and the lower locking strip is provided with a downwardly and an upwardly protruding locking element **74**, **73** respectively. The locking elements are provided with locking surfaces **41**, **42** configured to cooperate for horizontal locking of the floorboards.

An upwardly bending of the upper locking strip **71** across the edge (see FIG. **6***a*-**6***b*), facilitates a positioning of the downwardly protruding locking element **74** between the upwardly protruding locking element and an upper edge of the floorboard **3** in a position where the locking surface cooperates, as shown in FIG. **6***c*.

The downwardly protruding locking element is preferably provided with a guiding surface **79**, which is configured to cooperate (see FIG. **6***a*) with the upwardly protruding locking element **73** in order to facilitate the positioning.

Preferably, the upwardly protruding locking element **73** is provided with another guiding surface **77**, which is configured to cooperate (see FIG. **6***a*) with the guiding surface **79** to further facilitate the positioning.

It is also possible to only provide the upwardly protruding locking element **73** with a guiding surface, which is configured to cooperate with an edge of the downwardly protruding locking element.

The angle **44** of the guiding surface **79** and the angle of **43** said another guiding surface **77** are preferably more than about 30° and most preferably more than about 45°.

In a preferred embodiment the mechanical locking system is provided with one or more additional guiding surfaces, which guide the floorboards to the correct location for connection:

a guiding surface **80** at the downwardly protruding locking element, which guiding surface cooperates with an upper edge of the said other floorboard; and

a guiding surface **83** at the lower edge of the floorboard, which guiding surface cooperates with an edge or a guiding surface of the upwardly protruding locking element.

A space **81**, shown in FIG. **6***b*, under the upwardly protruding locking element facilitates bending of the lower locking strip during the connection of the lower locking strip. A space **72** above the upwardly protruding locking element ensures a proper connection of the floorboards, without risking that the floorboard is prevented reaching the position were the upper surfaces of the floorboards are in the same plane.

The number and area of the contact and locking surfaces should generally be minimized to ease connection of the floorboards. A small play **45** between the top edges of the floorboards (see FIG. **7***b*, **45**) makes them easier to install, but a tight (see. FIG. **7***a*) fit increases the vertical locking strength. To achieve a connection which is more resistant to moisture it is possible to have contact surfaces and a tight fit between the between the lower edges of the floorboards, which also increases the vertical and horizontal locking strength. However, the tight fit also makes it harder to connect the floorboards and a space (see FIG. **8***a*-*c*, **85**) makes it easier. An even more moisture resistant connection is achieved if the space **72** above the upwardly protruding locking element is eliminated (see FIG. **7***c*).

The angle **12** between the locking surfaces and the upper surface of the floorboards are preferably more than 90° to obtain a vertical locking in the position where the locking surface cooperates.

The locking strips **71**, **75** are integrally formed in the floorboard, and preferably the whole locking system is integrally formed in one piece with the resilient material of the floorboard. However, it is possible to add separate pieces to increase the locking strength, e.g. in the form of a tongue of stiffer material, of e.g. plastic or metal of e.g. aluminum, preferably for the vertical locking.

A downwardly bending across edge of the lower locking strip **75** (see FIG. **8***b*) further facilitates the positioning of the locking elements in the position where the locking surface cooperates. Bending of the lower strip is preferably achieved by positioning of a spacer **84** between the floorboard edge and the subfloor, and inside the lower locking strip such that the lower locking strip can bend freely. It is also possible to produce a lower locking strip whose lower part is removed to create a free space between the subfloor and lower the locking strip. However, that also reduces the bending strength of the locking strip, which is not desirable since a locking strip of resilient material, e.g. vinyl, has a relatively weak resilient strength. A reduced bending strength of the locking strip means a reduced locking strength of the locking system.

FIG. **9***a* shows an embodiment comprising a tongue **91** at the edge of a floorboard, cooperating with a tongue groove **92** at the edge of an adjacent floorboard, cooperating for vertical locking of the floorboards. The embodiment in FIG. **9***a* is provided with the tongue at the edge of the floorboard with the upper locking strip and the tongue groove at the edge of the floorboard with the lower locking strip. However it is also possible to provide the tongue at the edge of the floorboard with the lower locking strip and the tongue groove at the edge of the floorboard with the upper locking strip. These embodiments may be combined with the locking surface angle **12** that is more than 90°, as disclosed in FIGS. **6***a* to **8***c*, to obtain an increased vertical locking in the position where the locking surface cooperates.

The invention claimed is:

1. A set of resilient floorboards, each floorboard provided with a mechanical locking system for vertical and horizontal locking to an adjacent floorboard, the mechanical locking system comprising a first device at a first edge, and a second device at a second edge, wherein the first device comprises a downwardly protruding locking element that locks the first edge vertically and horizontally with the second edge of the adjacent floorboard, and an upper upwardly resiliently bendable locking strip that forms a convex shape towards a bottom surface of the floorboard during locking, and the second device comprises a lower locking strip, wherein the downwardly protruding locking element comprises an outermost side facing the adjacent floorboard, and the outermost side is provided with a chamfered guiding surface configured to cooperate with an uppermost edge of the adjacent floorboard during locking, and wherein the outermost side of the downwardly protruding locking element comprises at least a first vertical wall adjacent an angled lower wall that angles inward toward the chamfered guiding surface directly from the first vertical wall, and the chamfered guiding surface is below the angled lower wall.

2. The set of resilient floorboards according to claim **1**, wherein the lower locking strip of the second device is downwardly resiliently bendable.

3. The set of resilient floorboards according to claim **1**, wherein the second device comprises an upwardly protruding locking element that locks the second edge vertically and horizontally with the first edge of the adjacent floorboard.

4. The set of resilient floorboards according to claim **1**, wherein the floorboards are made of a thermoplastic material.

5. The set of resilient floorboards according to claim **3**, wherein the downwardly protruding locking element is provided with a first locking surface configured to cooperate with a second locking surface of the upwardly protruding locking element for horizontal locking of adjacent floorboards.

6. The set of resilient floorboards according to claim **3**, wherein the downwardly protruding locking element is provided with a first guiding surface configured to cooperate with the upwardly protruding locking element.

7. The set of resilient floorboards according to claim **6**, wherein the upwardly protruding locking element is provided with a second guiding surface configured to cooperate with the first guiding surface.

8. The set of resilient floorboards according to claim **6**, wherein the angle of the first guiding surface is more than about 30°.

9. The set of resilient floorboards according to claim **6**, wherein the angle of the first guiding surface is more than about 45°.

10. The set of resilient floorboards according to claim **7**, wherein the angle of the second guiding surface is more than about 30°.

11. The set of resilient floorboards according to claim **7**, wherein the angle of the second guiding surface is more than about 45°.

12. The set of resilient floorboards according to claim **5**, the angle between the first locking surface and the second locking surface and an upper surface of the floorboards is more than 90° to obtain a vertical locking in a position where the first locking surface and the second locking surface cooperate.

13. The set of resilient floorboards according to claim **1**, wherein the first edge is provided with a tongue and the second edge is provided with a groove for vertical locking of the floorboards.

14. The set of resilient floorboards according to claim **1**, wherein the first edge is provided with a groove and the second edge is provided with a tongue for vertical locking of the floorboards.

15. The set of resilient floorboards according to claim **1**, wherein the upper upwardly resiliently bendable locking strip and the lower locking strip are integrally formed in the floorboard.

16. The set of resilient floorboards according to claim **1**, wherein the floorboards are comprised of resilient material and the mechanical locking system is integrally formed in one piece with the resilient material of each floorboard.

17. The set of resilient floorboards according to claim **1**, wherein a space is provided between a subfloor on which the floorboards are arranged and the lower locking strip.

18. A set of resilient floorboards, each floorboard comprising resilient material and provided with a mechanical locking system for vertical and horizontal locking to an adjacent floorboard, the mechanical locking system comprising a first device at a first edge, and a second device at a second edge, wherein the first device comprises a downwardly protruding locking element that locks the first edge vertically and horizontally with the second edge of the adjacent floorboard, and an upper upwardly resiliently bendable locking strip that forms a convex shape towards a bottom surface of the floorboard during locking, and the second device comprises a lower locking strip and an upwardly protruding locking element that locks the second edge vertically and horizontally with the first edge of the adjacent floorboard, wherein the mechanical locking system is integrally formed in one piece with the resilient material of the floorboard, wherein the downwardly protruding locking element comprises an outermost side facing the adjacent floorboard, and the outermost side is provided with a chamfered guiding surface configured to cooperate with an uppermost edge of the adjacent floorboard during locking, and wherein the outermost side of the downwardly protruding locking element comprises at least a first vertical wall adjacent an angled lower wall that angles inward toward the chamfered guiding surface directly from the first vertical wall, and the chamfered guiding surface is below the angled lower wall.

19. The set of resilient floorboards according to claim **18**, wherein the lower locking strip of the second device is downwardly resiliently bendable.

20. A set of resilient floorboards, each floorboard provided with a mechanical locking system for vertical and horizontal locking to an adjacent floorboard, the mechanical locking system comprising a first device at a first edge, and a second device at a second edge, wherein the first device comprises a downwardly protruding locking element that locks the first edge vertically and horizontally with the second edge of the adjacent floorboard, and an upper upwardly resiliently bendable locking strip that forms a convex shape towards a bottom surface of the floorboard during locking, and the second device comprises a lower downwardly resiliently bendable locking strip and an upwardly protruding locking element that locks the second edge vertically and horizontally with the first edge of the adjacent floorboard, wherein the floorboards are made of a thermoplastic material, wherein the downwardly protruding locking element comprises an outermost side facing the adjacent floorboard, and the outermost side is provided with a chamfered guiding surface configured to cooperate with an uppermost edge of the adjacent floorboard during locking, and wherein the outermost side of the downwardly protruding locking element comprises at least a first vertical wall adjacent an angled lower wall that angles inward toward the chamfered guiding surface directly from the first vertical wall, and the chamfered guiding surface is below the angled lower wall.

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